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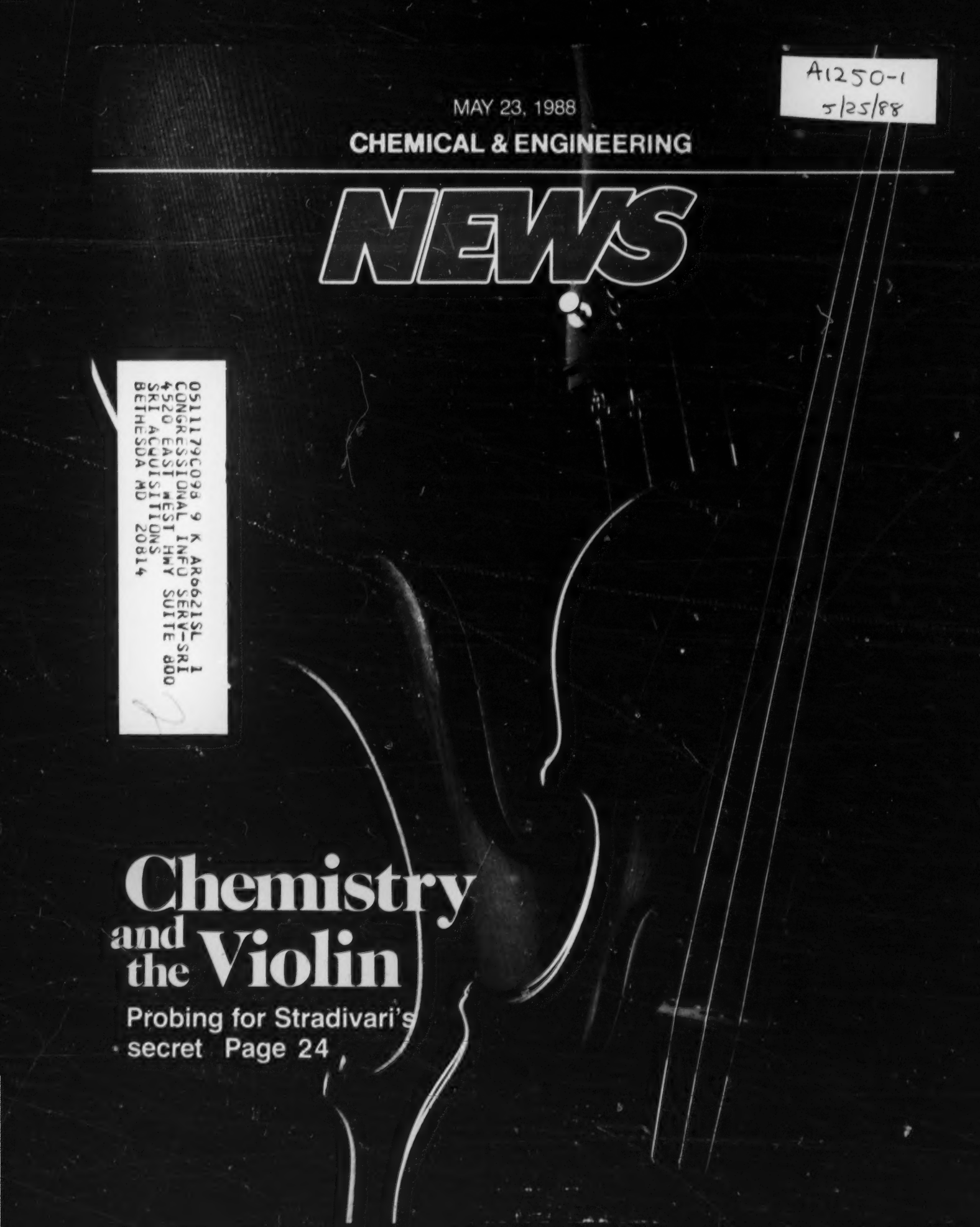

Chemistry and the Violin

Probing for Stradivari's secret Page 24

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MAY 23, 1988

News of the Week

■ **Surprise amendments to NSF's authorization bill would establish an investment banker role for the agency and put onus on the agency to ensure drug-free environments in the laboratories it funds.** **Page 4**

■ **OSHA cites Hoechst Celanese for failing to provide a safe working environment at its Pampa, Tex., plant, where fatal explosions occurred last November.** **Page 5**

■ **Health groups and their supporters in Congress launch new assault on tobacco industry after Surgeon General issues report that indicts nicotine as addictive drug.** **Page 5**

■ **Soviets are expected to take part in NASA expedition, set for early '89, to probe Arctic stratosphere for signs of ozone depletion catalyzed by chlorine from CFCs.** **Page 6**

■ **Du Pont's plan to give severance pay to its employees at the Department of Energy's Savannah River plant hits snags in Congress and with DOE.** **Page 6**

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Business

Chemical companies had significantly more cash last year as a result of rapidly increasing profits, a C&EN survey shows. **Page 9**

Government

Perceptions in Europe and U.S. of chemical risks differ, with Europeans more concerned about nuclear power, air pollution. **Page 12**

Pentagon's CBW research program has safety management problems, a Senate subcommittee finds. **Page 13**

Science

Research institute, headed by Thailand's Princess Chulabhorn, a Ph.D. chemist, aims to support country's development. **Page 15**

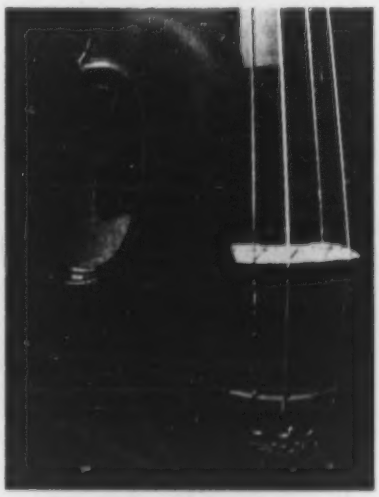
Education

Connecticut university's use of computerized lab management system marks move of software from industrial into academic setting. **Page 17**

Technology

International effort aims to design nuclear fusion reactor by the close of 1990. **Page 18**

Increased support for microgravity research on materials and materials processing is urged by NRC committee. **Page 21**



Special Report

Chemistry plays a role in the acoustical quality of the famous old Italian violins and may help unravel the secret of the classic string instruments. **Page 24**

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LETTERS

Nuclear energy

SIR: The letter of Miles Robinson (C&EN, April 11, page 5) provides proof of what many of us have long suspected: that medical education is insufficiently rigorous in analytical content, for even a modicum of research (with an open mind) and thought would show that compared to all other forms of energy, nuclear energy exacts the least cost in human lives and that we could afford a Chernobyl a year rather than accept the human loss involved in the extraction of equivalent amounts of fossil fuels.

High-level nuclear wastes can be stored in depositories whose lifetime is measured in hundreds of thousands of years to tens of millions before failure. Public aversion to nuclear power is a childish perception rooted in the technological ignorance of our public.

Walter E. Pittman
Professor, History of Science
Mississippi University for Women

Fossil fuel sources

SIR: In the discussion of atmospheric ozone depletion (C&EN, Aug. 17, 1987, page 7; Nov. 2, 1987, page 22) and the substances that may consume ozone, we are impressed by the omission of fossil fuel sources—and specifically coal. Some of our research findings show that percent levels of fluorine and chlorine are common in coal. Further investigations also showed that, although fluorine may be inorganically bound as fluorite (CaF_2), substantial amounts of fluorine are found in macerals (e.g., fusinite).

The organic affiliation of fluorine (and possibly chlorine) in coal leaves open the possibility that coal combustion (and possibly burning other fossil fuels) could contribute significantly to the anthropogenic fluxes of fluorine and chlorine to the atmosphere. Given the annual global coal combustion rate of 4 to 5 billion metric tons and a conservative fluorine level of 0.1%, then 4 to 5 million metric tons of fluorine could be released annually from coal burning.

In fusinite-rich coals organically bound fluorine has been observed as the dominant fluorine environment, and this could be an important source of coal-derived fluorine (and possibly of chlorine and chlorofluorocarbons). Assuming 10% of the total halogen component is organic, about 500,000 metric tons (5×10^{11} g) could be released each year during coal combustion.

We wish to underscore here the need for better monitoring of light halogen (i.e., F, Cl) levels in coal (including the phases with which they are associated), as well as for the fate of light halogens in the coal fuel cycle, especially where high-fusinite coals are being or could be used in the future.

J. R. Brown
Kanata, Canada
W. S. Fyfe
Faculty of Science, University of Western Ontario, London, Ontario, Canada
B. I. Kronberg
Geology Department, Lakehead University, Thunder Bay, Ontario, Canada

Health and nuclear power plants

SIR: Bernard L. Cohen (C&EN, Dec. 7, 1987, page 46) disputes my contention (C&EN, Oct. 19, 1987, page 2) that "misuse of public funds such as for 'protection' against natural low-level radon, is in great need of examination." He states, "If currently accepted (linear, no threshold) theories are correct, we are spending $2 billion per life saved from nuclear industry radiation, but only $4000 per life saved from radon exposure." Has he inferred causality from statistics? He also refers to a "waste of money trying to make nuclear power safe."

The linear, no-threshold hypothesis (ideology?) must be considered to be scientifically invalid on the ground that it is incompatible with observed data. It is also incompatible with extensive evidence on the reality of the biophysical phenomenon of radiation hormesis, as discussed in depth by T. D. Luckey [e.g., "Hormesis with Ionizing Radiation," CRC Press, Boca Raton, Fla., (1980); *Health Phys.*, **43**, 771 (1982); *Z. Phys. Med. Baln. Med. Klim.* (Sonderheft 1), **13**, 11 (1984); *Radiat. Res.*, **108**, 215 (1986)], and by R. J. Hickey and E. J. Bowers ["Physics in Medicine & Biology Encyclopedia," Vol. 1, McAinsh, T. F., editor, Pergamon Press, Oxford, U.K., page 387 (1986)]. Furthermore, H. L. Gjørup and H. J. M. Hansen (Health Physics Department, Risø National Laboratory, Roskilde, Denmark) reported, during a conference on health effects of low-dose ionizing radiation in London on May 11-14, 1987 ("Lifetime loss through lung cancer in Denmark and Sweden"), that although ^{222}Rn levels in homes in Sweden are about 2.1 times higher than in homes in Denmark, the loss due to lung cancer, 1972-78, was 2.0 times that in Sweden.

Earlier, in two press articles—one in

Continued on page 47

Chemical Companies' Cash Rose Markedly Last Year

However, inventories and receivables, as well as other day-to-day financing needs, also increased in 1987, C&EN survey indicates

William J Storck, C&EN New York

In these days of rapidly increasing corporate profits in the chemical industry, there is only so much that companies can do with the cash that they are receiving. They can increase dividends, they can use it to modernize plants, they can pay down debt, or they can hold on to it. And U.S. chemical firms seem to be doing all of these—but especially they are holding on to their money.

A C&EN survey of 20 U.S. chemical companies shows that the total of cash and marketable securities and current assets increased markedly in 1987 and current liabilities increased much more slowly. The result was increasing liquidity ratios for the firms.

The pattern among the companies is following that usually seen well into an economic recovery. The earnings momentum is providing cash for the chemical companies fast enough that they are having trouble getting rid of it. At the same time, however, current liabilities, the day-to-day financing needs of the companies, also are increasing. In fact, the only major component of financial obligation that declined for the companies in 1987 was short-term debt—a financing need that can quickly and easily be taken care of by cash on hand.

The larger cash amounts that companies had to work with in 1987 brought about something of an anomaly. Companies' two big cash drains are inventories and receivables, even though these two items are accounted for as current assets. When these increase, usually cash becomes short and short-term debt also increases. However, in spite of increases in inventories and receiv-

Cash and cash ratios increased last year

	1987			1986			1985			1982 (recession)		
	Cash and marketables ($ millions)	Current ratio	Cash ratio	Cash and marketables ($ millions)	Current ratio	Cash ratio	Cash and marketables ($ millions)	Current ratio	Cash ratio	Cash and marketables ($ millions)	Current ratio	Cash ratio
Air Products[a]	$ 96.6	1.3	0.22	$ 116.7	1.5	0.25	$ 46.2	1.3	0.09	$ 64.3	1.2	0.14
American Cyanamid	533.4	1.5	0.38	446.4	1.7	0.40	552.1	2.0	0.55	176.0	1.3	0.15
Dow Chemical	418.0	1.7	0.12	365.0	1.6	0.12	114.0	1.5	0.04	183.0	1.8	0.08
Ethyl	62.0	2.3	0.27	53.8	2.4	0.28	80.4	2.1	0.37	94.0	2.3	0.45
Georgia Gulf	24.2	1.8	0.24	3.2	2.0	0.05	1.2	1.1	0.01	na	na	na
B. F. Goodrich	110.9	1.4	0.22	51.9	1.4	0.12	58.9	1.2	0.07	44.9	1.6	0.09
W. R. Grace	151.4	1.5	0.13	92.5	1.3	0.08	151.6	2.0	0.15	164.5	1.7	0.17
Hercules	694.5	3.6	1.40	55.5	2.6	0.13	28.5	2.5	0.07	34.2	2.2	0.10
Loctite[b]	57.2	1.9	0.55	53.3	2.3	0.73	58.0	2.0	0.77	54.7	2.4	0.94
Lubrizol	92.7	3.0	0.55	85.6	2.8	0.53	63.0	2.5	0.35	25.4	2.7	0.22
Monsanto	223.0	1.7	0.12	274.0	1.6	0.16	293.0	1.4	0.12	414.0	2.6	0.44
Nalco Chemical	61.5	1.8	0.38	20.4	1.8	0.17	7.5	1.9	0.08	70.0	2.3	0.76
Olin	34.0	1.7	0.08	9.0	1.5	0.02	47.9	1.8	0.12	77.1	1.8	0.20
Pennwalt	53.4	2.0	0.21	60.6	2.2	0.29	58.4	1.7	0.21	14.7	1.9	0.08
Petrolite[c]	33.6	2.5	0.60	43.9	3.1	1.02	33.0	3.5	0.82	18.7	3.0	0.47
Quantum Chemical	24.9	1.4	0.04	87.3	1.1	0.08	47.3	1.5	0.09	141.1	3.5	0.60
Rohm & Haas	220.0	2.0	0.46	246.0	2.2	0.57	219.0	2.1	0.49	113.8	2.9	0.45
Union Carbide	201.0	1.4	0.11	299.0	1.3	0.16	459.0	1.3	0.15	154.0	2.0	0.09
Vista Chemical[a]	7.9	1.6	0.06	2.3	1.8	0.02	2.6	5.7	0.03	na	na	na
Witco	227.2	3.1	1.12	67.5	2.5	0.41	83.0	2.3	0.48	49.0	2.2	0.32
TOTAL (average for ratios)	**$3327.6**	**2.0**	**0.36**	**$2434.0**	**1.9**	**0.28**	**$2404.6**	**2.1**	**0.25**	**$1893.4**	**2.2**	**0.32**

Note: Current ratio is current assets divided by current liabilities. Cash ratio is cash and marketable securities divided by current liabilities. a Fiscal year ending Sept. 30. b Fiscal year ending June 30. c Fiscal year ending Oct. 31. na = not available.

Daily financing requirements rose in 1987

$ Millions	Inventories	% change 1987	% change 1986	Receivables	% change 1987	% change 1986	Accounts payable	% change 1987	% change 1986	Short-term debt[a]	% change 1987	% change 1986
Air Products	$ 127.0	−8%	0%	$ 289.9	−23%	−2%	$ 227.3	−12%	−1%	$ 21.1	−37%	−50%
American Cyanamid	676.8	17	−4	931.8	8	8	989.5	16	19	43.0	17	−86
Dow Chemical	1637.0	9	−26	2,269.0	32	−21	1583.0	34	−8	179.0	−36	−40
Ethyl	154.2	8	2	296.5	26	10	107.8	54	−15	0.8	6	−39
Georgia Gulf	54.8	−4	−21	95.4	26	0	55.7	23	−9	0	—	—
B. F. Goodrich	317.5	11	−28	264.4	1	−47	221.5	16	−33	53.7	−13	−77
W. R. Grace	629.5	12	−7	826.5	24	−5	521.1	21	6	148.4	−3	−48
Hercules	402.4	−12	5	698.6	23	−3	184.2	18	0	34.1	−51	−39
Loctite	50.4	19	19	85.0	28	43	20.8	33	34	36.6	103	−4
Lubrizol	208.2	7	−10	198.3	20	8	91.1	6	−6	13.6	215	−86
Monsanto	1081.0	1	−3	1,534.0	22	−22	527.0	15	−12	539.0	39	−45
Nalco Chemical	66.4	10	9	145.3	23	1	67.4	17	23	35.2	106	−19
Olin	273.0	3	−1	362.0	14	−2	200.0	17	4	50.0	−4	9
Pennwalt	195.2	22	2	206.5	7	−4	93.2	44	−15	48.6	0	−52
Petrolite	38.1	25	−29	56.0	15	−17	31.5	35	−12	15.5	41	142
Quantum Chemical	315.9	2	−26	434.1	8	19	133.5	1	23	114.0	−86	191
Rohm & Haas	309.0	0	−9	356.0	12	1	339.0	13	15	107.0	−3	−35
Union Carbide	827.0	11	−48	1,294.0	19	−34	559.0	35	−12	317.0	−31	−57
Vista Chemical	85.6	15	−2	101.9	16	7	41.7	−4	−3	20.9	−19	46
Witco	151.3	9	13	228.6	18	1	148.6	18	−2	4.0	9	−56
TOTAL	**$7600.4**	**7%**	**−18%**	**$10,673.9**	**18%**	**−14%**	**$6142.8**	**21%**	**−2%**	**$1781.5**	**−32%**	**−35%**

a Includes long-term debt payable within one year.

ables in 1987, short-term debt declined. Thus is the power of earnings-generated cash.

Analysts seem little worried about the increase in inventories last year since the companies do have cash on hand to finance them. Also, they point out, chemical companies, because of tight supply situations in many chemical markets, had been increasing inventories at the end of the year in anticipation of scheduled maintenance shutdowns this year. Since inventories, and indeed all balance sheet items, are measured at the end of the fiscal year, this may have tended to inflate the inventory situation.

For the 20 large chemical companies surveyed by C&EN, cash and marketables increased 37% in 1987 to a combined total of about $3.33 billion. It must be pointed out, however, that although an increase in cash is good, too much cash can be a large factor in making a company an attractive takeover candidate. If cash far outweighs the potential short-term needs for that cash within a corporation, then it potentially can be used to pay down acquisition costs of an acquiring company if the takeover is successful.

The large increase in cash among the companies was certainly helped by divested operations at a few of the firms. For instance, Hercules sold off its interest in Himont, which sent its cash soaring more than 12-fold to $695 million.

The large increase in cash and marketables last year also helped push up current assets. This balance sheet item increased about 14% in 1987 to end the year totaling $23.9 billion for the 20 companies. At the same time, however, current liabilities also increased, rising about 5.6% to end the year at a total of about $13.9 billion.

The result, however, was good in that the average cash ratio (cash and marketables divided by current liabilities) for the 20 companies was 0.36, up from 0.28 at the end of 1986 and up from 0.25 at the end of 1985. The average current ratio (current assets divided by current liabilities) at the end of 1987 was 2.0, up from 1.9 in 1986, but down from 2.1 at the end of 1985. The cash ratio last year finally was higher than the 0.32 scored at the end of recession year 1982, but the current ratio of 2.0 was still below the 2.2 seen at the end of 1982.

Except for short-term debt, daily financing requirements of the 20 companies rose last year. As a group, the companies' combined inventories increased 7% to about $7.6 billion at the end of the year, compared with an 18% decline the previous year. The firms' combined receivables increased 18% from 1986 to $10.7 billion, following a 14% decline in 1986. And accounts payable rose 21% last year to $6.14 billion, following a 2% decline in 1986.

Short-term debt at the end of 1987 declined 32% to $1.78 billion following a 35% decline in 1986.

With all signs pointing to continued good earnings performance in the chemical industry for the next few quarters at least, the companies' cash on hand likely will continue to rise. Inventories probably will be drawn down as the industry enters the summer and uses stocks on hand during maintenance downtimes. Thus, the industry could well see at least some of the liquidity measures improving this year. Given the age of the current expansion phase of the business cycle, the industry probably will have lower current ratios even though the cash ratio may continue to expand. □